REMARKS

This is in response to the Office Action dated June 07, 2005, in which Claims 19-22 were withdrawn from consideration by the Examiner, Claims 1-14 and 23-24 were rejected, and Claims 15-18 were allowed. Claims 1, 5-7, 9 and 23 have been amended as above. It is respectfully submitted that, as amended, all the pending claims are allowable.

Amendment

Claims 5-7 have been amended to overcome the rejection under 35 U.S.C. 112, second paragraph.

In Claim 1, the feature "the ridge segments and the trenches form a transmission line with a second characteristic impedance, wherein the transmission line is operative to slow down a wave propagating therethrough and the second characteristic impedance is no smaller than the first characteristic impedance" has been added. Such claim feature has been fully supported in the specification as originally filed. For example, in paragraph [0012], the Applicant discloses the method of "**maintaining a characteristic impedance of and reducing a size of a waveguide operating at a certain frequency.** ... , such that the ridge segments and the gaps **form a transmission line operating in such a way as to slow a wave propagation down the waveguide.**" Similar disclosure can also be found in paragraph [0024], which provides exemplary dimensions of the waveguide, the ridges, and the trenches between the ridges, so as **to increase the characteristic impedance**.

Therefore, the amendment made to Claim 1 does not raise any new subject matter.

In Claim 9 and 23, similar features such as "each of the ridge ... is spaced from the ridge segment adjacent thereto by a distance to result in a second characteristic impedance equal to or larger than the first characteristic impedance" and "c) configuring the gap to increase a characteristic impedance of the transmission line when a wave propagating therethrough." as added, respectively, are also fully supported by the originally filed specification (paragraphs [0012] and [0024]), such that no new subject matter has been raised by the amendment.

Summary of Claim Rejection Under 35 USC 102 & 103

Claims 1-3, 5-10, 12-14, 23 and 24 were rejected under 35 U.S.C. 102(e) as being anticipated by Saad (US'039) and Claim 4 were rejected under 35 U.S.C. 103(a) as being unpatentable over Saad (US'039).

Saad teaches forming spaced ridges in a waveguide filter to allow propagation of TE_{10} mode of wave in an evanescent mode, that is, to provide a bass band under a cutoff frequency for TE_{10} wave.

As known in the art, an evanescent mode is defined as a mode in which the operation frequency of a wave is lower than a cutoff frequency of the waveguide. When the operation frequency of the wave is lower than the cutoff, the wave is rapidly attenuated. Therefore, the evanescent mode is often referred as an non-propagating mode.

Therefore, **to allow propagation of the TE_{10} mode or to provide a pass band of TE_{10} wave within the evanescent mode**, the frequency of the TE_{10} wave has to be increased higher than the cutoff frequency, or the **cutoff frequency of the waveguide has to be decreased lower than the frequency of the TE_{10} wave.**

When **a waveguide serves as a transmission line** allowing a specific TE wave to propagate through, the characteristic impedance η_{mn}^{TE} for such TE mode of wave can be calculated from:

$$\eta_{mn}^{TE} = \frac{\eta}{\sqrt{1 - \left(\dfrac{f_{cmn}}{f}\right)^2}}$$

Evidently, when the cutoff frequency f_{cmn} is reduced, the resultant characteristic impedance η_{mn}^{TE} is consequently reduced.

Therefore, to render Saad satisfactory for its the intended purpose, that is, to allow propagation of TE_{10} wave within an evanescent mode, the cutoff frequency of the waveguide filter has to be decreased by formation of the ridges and trenches. As a result, the characteristic impedances is reduced. This actually teaches away "the second characteristic impedance being no smaller than (equal to or larger than) the first characteristic" in Claims 1, 9 and 23".

In contrast, Claims 1, 9 and 23 specifically discloses that formation of the ridge segments and the trenches prevent the characteristic impedance of the waveguide from being reduced. Therefore, the ridge segments and trenches have to be dimensioned differently from the those of the spaces 20 disclosed by Saad.

Therefore, although Saad teaches the spaces 20 between the ridges 18, Saad fails to teach the maintaining or increasing the characteristic impedance of the waveguide; and consequently, fails to teach the ridges and trenches so dimension prevent the characteristic impedance from being reduced.

As a matter of fact, to satisfy the intended purpose of providing a passband within the evanescent mode, Saad inevitably reduces the characteristic impedance and teaches away the claimed subject matter. Therefore, Claims 1-8, 9-10, 12-14 and 23-24 are not anticipated by nor obvious over Saad, and the rejection is respectfully traversed.

Claim Rejection – 35 USC § 102

Claims 1-3, 5-10, 12-14, 23 and 24 were rejected under 35 U.S.C. 102(e) as being anticipated by Saad (US'039).

Saad discloses a lowpass waveguide filter operates in at least a TE_{10} evanescent mode and a TM_{11} evanescent mode. In col. 3, lines 40-45 and col. 4, Claim 2, Saad further teaches "the parallel capacitance and series inductance occurring in the TE_{10} mode and the series capacitance occurring in the TM_{11} mode.

By definition, the evanescent mode of a waveguide is the mode when the operating frequency of a wave is lower than a cutoff frequency; and no wave propagation will take place in such mode. When a TM wave travels along a rectangular waveguide having a cross section of $a \times b$, and when the frequency f of a wave to travel along the rectangular waveguide is lower than the cutoff frequency f_c, the E field along the propagation direction $\widetilde{E}_z$ of the TM wave can be expressed as:

$$\widetilde{E}_z = \dot{E}_{zm} \sin\left(\frac{m\pi}{a}x\right)\cos\left(\frac{n\pi}{b}y\right)e^{-\alpha_{mn}z},$$

Evidently, $\widetilde{E}_z$ attenuates exponentially along the direction of propagation. As all field components of the TM wave are dependent on $\widetilde{E}_z$, they also attenuate inside the waveguide.

Therefore, **no wave propagation will take place if the frequency of the wave is less than the cutoff frequency of the waveguide. Such a wave is said to be evanescent.**

Similarly, a TE wave operates below the cutoff frequency also renders the TE wave to vanish within the waveguide. **To allow a specific wave to transmit through a waveguide, the cutoff frequency f_c of such mode has to be reduced lower than the operation frequency thereof. Otherwise, the waveguide cannot function as a transmission line to propagate the specific mode of wave.**

Saad discloses forming successive ridges 18 for generating parallel capacitors C_p and the inductors L_s to provide pass band for TE_{10} mode and the closely spaced top-loadings 22 on the ridges 18 to provide pass band for TM_{11} mode. As a consequence, the pass bands of both TE_{10} and TM_{11} are provided under the cutoff frequency f_c. This, as understood, is equivalent to **reduce the cutoff frequency of the TE_{10} and TM_{11} modes under the frequencies thereof.**

It is understood that a TE_{mn} mode of wave operative to propagate or transmit through a waveguide transmission line will have the characteristic impedance expressed as:

$$\eta_{mn}^{TE} = \frac{\eta}{\sqrt{1-\left(\dfrac{f_{cmn}}{f}\right)^2}}.$$

It thus appears that, when the cutoff frequency is reduced, the denominator of the above equation is increased; and consequently, the characteristic impedance will be reduced.

As understood, to allow a specific mode of wave (such as TE_{10}) to propagate through the waveguide filter under its original evanescent mode, the inductor length, that is, the length of the trenches between the ridge segments, have to be specifically dimensioned. For example, the maximum distance between adjacent ridges 18 of Saad is about ½ of the maximum wavelength of the block band (Referring to Chappell, US Patent No. 3,949,327 cited in Saad). Based on the above equation, to reduce the cutoff frequency for the TE_{10} mode of wave, such dimension actually **renders the TE_{10} mode to propagate through the waveguide with reduced characteristic impedance.**

Claim 1

In Claim 1, the ridge is partitioned by a plurality of trenches into a plurality of ridge segments to form a transmission line operative to slow down a wave propagating therethrough and having a second characteristic impedance no smaller than the first characteristic impedance. In other words, the trenches have to be specifically dimensioned to slow down the wave propagation without decreasing the characteristic impedance. In contrast, Saad discloses a waveguide having spaces between ridges so dimensioned to reduce cutoff frequency and inevitably decreases the characteristic impedance. Therefore, although Saad discloses a plurality of ridges 18 and spaces 20 between the ridges, the dimensions of the spaces 20 are differently configured from the trenches as claimed.

Therefore, by specifically teaching the pass bands of the TE_{10} and TM_{11} modes in evanescent modes, Saad teaches that the spaces are dimensioned to not only reduce the cutoff frequency, but also reducing the characteristic impedance. Therefore, Saad fails to teach "the trenches and the ridge segments form a transmission line operative to slow down a wave propagating therethrough and having a second characteristic impedance larger than the first characteristic impedance" as claimed in Claim 1. As Saad fails to teach every element as claimed in Claim 1, the rejection under 102(e) is respectfully traversed.

Further, as the dimension disclosed by Saad actually provides an opposite effect in the characteristic impedance, Saad teaches away Claim 1.

Therefore, Claims 1-8 are patentable over Saad.

Claim 9

In Claim 9, each of the ridge segments is spaced from the ridge segment adjacent thereto by a distance to result in a second characteristic impedance equal to or larger than the first characteristic impedance.

Again, although Saad discloses a device having ridges separated from each other by spaces, the dimension of the spaces is defined to reduce the cutoff frequency, and consequently reduce the characteristic impedance. Therefore, the dimension to allow the characteristic impedance to be increased is different from the dimension as disclosed by Saad. Therefore, Saad fails to discloses every element as claimed in Claim 1, and the rejection over Claims 9-10 and 12-14 under 35 U.S.C. 102(e) is respectfully traversed.

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Claim 23

In Claim 23, a method of maintaining a characteristic impedance <u>of a waveguide</u> <u>operating at a certain frequency</u> is claimed. The method includes step d) ... <u>wherein a length</u> <u>of each inductance is so configured to allow size reduction of the waveguide while increasing</u> <u>a characteristic impedance when a wave traveling therethrough.</u>

Again, as the length of each inductance allowing size reduction while increasing a characteristic impedance is different from the length allowing propagation of the wave in evanescent mode, Saad fails to teach step (d) as claimed. Therefore, the rejection over Claims 23 and 24 is respectfully traversed.

Claim Rejection - 35 USC § 103

Claim 4 was rejected under 35 U.S.C. 103(a) as being unpatentable over Saad (US'093).

Claim 4 is dependent on patentable Claim 1 and is thus patentable over Saad. Further, there is no evidence in Saad showing the suggestion and motivation for modifying the rectangular waveguide into a waveguide with a circuit cross section. Therefore, the rejection is respectfully traversed.

In view of the foregoing, all the pending claims are believed allowable, and the application is believed to be in condition for allowance. Entry of the amendments and issuance of a Notice of Allowance is therefore respectfully requested. Should the Examiner have any suggestions for expediting allowance of the application, please contact applicant's representative at the telephone number listed below.

If any additional fee is required, please charge Deposit Account Number 19-4330.

Respectfully submitted,

Date: _Oct 5, 2005_ By: _____

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